

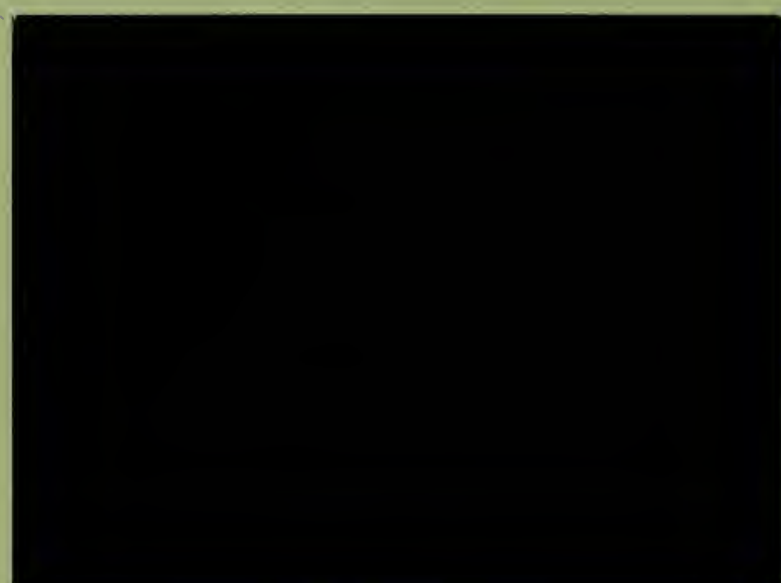
NPS CPSU - Technical Report

FINAL REPORT
Aquatics Resources Advisory Team
Cape Hatteras National Seashore,
North Carolina
2-3 March 1986

CPSU TECHNICAL REPORT 24

National Park Service Cooperative Unit
Institute of Ecology
The University of Georgia
Athens, Georgia 30602

NATIONAL PARK SERVICE
WATER RESOURCES DIVISION
FORT COLLINS, COLORADO
RESOURCES MANAGEMENT



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The U.S. National Park Service Cooperative Park Studies Unit at the Institute of Ecology (University of Georgia, Athens) produces the *CPSU Technical Report* series. Its purpose is to make information related to U.S. National Parks quickly and readily available to interested scientists and park staff. Each contribution is issued in limited quantities as a single number within the series. Contributions are from various sources, not all federally funded, and represent data matrices, bibliographies, review papers and scientific project reports. They may supply scientific information or describe resources management activities. Reports are not intended to determine park policy, although management recommendations are sometimes included.

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Final Report: Aquatic Resources Advisory Team. Cape Hatteras National Seashore, North Carolina. 2-3 March 1986.

Aquatics Resources Advisory Team. CPSU Technical Report 24. Univ. Georgia, Athens. 12 pp. May 1986.

Abstract

A six-member advisory team, led by Dr. Susan Bratton (CPSU, University of Georgia) and Kent Turner (Cape Hatteras National Seashore) visited various sites on and near Cape Hatteras National Seashore from March 2-3, 1986 to assess existing and potential water-related management problems promoted by rapid growth in communities bordering the Seashore.. The team identified the primary resources management problems and proposed actions with four top priorities for research and monitoring: (1) protection of Buxton area sedge and swale wetlands; (2) assessment of water quality park-wide, particularly near existing and potential development; (3) development of a successful water management program and the mitigation of development impacts, with the aid of an informed public; and (4) monitoring natural changes in park wetlands. The team recommended specific management actions, and research and monitoring efforts that would allow achievement of these objectives.

Introduction

The legislation establishing Cape Hatteras National Seashore allows for the existence of towns and villages to remain on its northern boundary (Bodie Island) of private land, and at its southern terminus on Ocracoke Island. Although there were several villages and summer home communities on the Outer Banks before the National Seashore was established, residential development has greatly accelerated in recent years. Numerous new homes have not only been built in villages such as Rodanthe, Avon, and Buxton, but greatly expanded development has occurred in the Kitty Hawk and Nags Head areas to the north of the park. Dare County, in fact, is the fastest growing county in North Carolina. Shortage of fresh water is already a concern for some of these communities, and increased withdrawal of water may initiate hydrologic changes for the entire Outer Banks. Further, the ecology of fresh water communities within the park may be influenced by such diverse factors as rise in sea level, storm overwash, changes in natural fire regime, artificial drainage and diking, anthropogenic drawdown of the water table, and air and water pollution. Both fresh water and estuarine communities may be vulnerable to water pollution, and many of the estuaries may be influenced by dredging and construction activities. A proper understanding of the hydrologic dynamics of the park is not only necessary to maintaining ecologically rich interior wetlands which are also a very important scenic resource, but may actually be important to understanding the dynamics of terrestrial plant communities, such as the forest stands at Buxton Woods. The purpose of this advisory team was to assist Cape Hatteras National Seashore in developing a long-term research and resources management strategy for aquatic systems.

Advisory Team Participants

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Team Schedule

The Advisory Team met Sunday, 2 March 1986, and traveled to Buxton Woods. The team visited new private home sites adjoining the park boundary and the developed wellfield of the Cape Hatteras Water Association. The team then stopped in Avon to view development along Pamlico Sound. On March 3 (Monday) the team observed drainage problems and new housing, including septic tank placement in South Nags Head, and the drainage ditches on adjoining park lands on Bodie Island. The team then met at Park Headquarters and discussed existing and potential management problems and research and monitoring strategies under three primary categories:

1. water quantity and level;
2. effluent; and
3. natural changes in aquatic systems.

The team established suggested priorities for research or monitoring and for management action by considering the relative value of the wetland ecosystems in question as natural areas, the possibility of system change or degradation in the near future, the previous managerial history of individual cases (including requests by local municipalities for park participation or action in solving water management problems) and the probability of future private development affecting the aquatic resource in question. The team assumed that high priority managerial action could be initiated simultaneously with new basic research or monitoring programs. Both the major problem areas and the actions to be taken are prioritized.

Primary Resources Management Problems and Proposed Actions

Priority One

Protection of Buxton area sedge and swale wetlands. The most ecologically distinctive and important natural wetlands in Cape Hatteras National Seashore are located between the forested ridges of Buxton Woods. Floristically diverse, these periodically flooded swales support plant communities that vary from open freshwater marshes, to sawgrass glades, to swamp forest. Housing development is slowly spreading along the park boundary. The Cape Hatteras Water Association has a wellfield along the park's northwestern boundary, and is planning to bring a second wellfield into production. Both are within a few hundred meters of these major park wetlands.

The advisory team suggested that the wellfields are not presently a threat to the integrity of park wetlands, due to the moderate rates of water withdrawal (25 gallons per minute per well). Should this rate of withdrawal double (50 gallons per minute), water table drawdown and salt water intrusion into the wells may become concerns. Water association productivity would therefore need to quadruple over present production before the park lands are likely to be adversely affected. Present plans are for daily capacity to double from 800,000 gallons per day to 1.6 million gallons per day with the addition of the second wellfield.

The advisory team suggested, however, that housing and other development activities may result in diking, drainage, or filling of wetlands adjoining the park, and also result in increased linkage of effluent into park surface waters.

A Carrying Capacity Study of Hatteras Island. Under a moderate intensity scenario for development, dwelling units and populations on Hatteras Island will quadruple before reaching buildout (Brower).

The park does not own the entire Jeanette Sedge, the largest contiguous area of wetland within the park on Hatteras Island. The National Park Service needs to take managerial action to limit modification of park wetlands and needs to establish a data base on their present condition.

Management Action:

1. Determine what management options are available to regulate or mitigate filling of wetlands in Buxton Woods. For example: Does the area contain Section 404 wetlands? Is it a current or potential AEC (under NC Coastal Management Act)?
2. If modifications to wetland areas outside the park continue, consider use of silt fencing to protect park wetlands.
3. Determine what records or monitoring data (rates of pumping, water levels) are maintained by the Cape Hatteras Water Association. Open communications with Cape Hatteras Water Association, expressing our general and mutual concerns. Determine their current or planned monitoring program; emphasize the benefit of monitoring water levels and salinity within the wellfield. Monitor variables of mutual concern, such as coliform counts and watershed protection, and cooperate on measures as the area grows.

Research and Monitoring

Inventory of natural park wetlands, particularly those in Buxton Woods, should include the following items:

1. A topographic map of Buxton Woods and Hatteras Island, with one-foot contours. This map would allow computation of probable flow patterns, evaluation of possible drainage modification by development, and the depth and extent of the wetlands.
2. A hydrologic study of the swale system at Buxton, including surface flow patterns and development of a water budget, incorporating evapotranspiration studies of the maritime forest.
3. Development of detailed maps and ecological analysis of the vegetation of natural park wetlands, including the lighthouse pond on Bodie Island. This project should include species lists, plant community classification, phenology, and definition of the relationships of wetland patterns to environmental factors, particularly various water depths.

All these elements should be accomplished by expert consultants from universities, private firms, or state/federal agencies. Low elevation aerial photography of Buxton Woods is necessary for accurate topographic and vegetation mapping. These projects need to be carefully coordinated to produce a managerially useful final product. Water planning should be coordinated with projected population growth and water use estimates. State and county planning studies and demographic information, as well as water quality data, may be utilized to predict potential problems.

Priority Two

The assessment of water quality park-wide, particularly near existing and potential development. The largest water quality threat was judged to be effluent, both from septic tanks (there is no current nor anticipated municipal sewage treatment) and impervious surfaces. It was pointed out that effluent volumes will be directly tied to the additional raw water demands within the park. In the absence of manufacturing or centralized water treatment, the raw water taken from the system will be returned as untreated or gray water. The team also pointed out that storms, flooding and periods of high water will provide the greatest opportunity for dissemination of contaminants into park systems.

The team determined the Buxton Woods wetland areas to be most vulnerable to water quality problems, as the Buxton system is the only significant fresh water system within the park, and is dependent upon ground water. The South Nags Head/Bodie Island marsh area was deemed the second priority, due to existing drainage ditches directly connecting the town and park areas. Other town areas are deemed areas of concern but of lesser priority, primarily due to lack of park ownership or jurisdiction along the sound in these areas. The general groundwater diffusion gradient is towards the ocean and sounds (Winner) with little general lateral movement along the islands. These areas should be monitored, however, to provide information on the general health of the estuarine system and track potential movement into park areas.

Management Actions

1. The park should support a comprehensive water management (drainage) plan for the South Nags Head area, with the proviso that random tie-in to existing ditches draining through the park is unacceptable, since impacts could not be predicted. Any such drainage plan should be based upon careful topographic (flow) studies and

careful monitoring of water accepted by the park.

2. The park should determine current water sampling tests and locations currently being run by the state, either through the Department of Environmental Management, Fisheries, or Shellfish Sanitation.
3. The park should seek assistance from public health agencies (Marine Resources Center may have resources) to determine mosquito vector potential generated by the park's fresh wetlands. This may be helpful should drainage requests be couched in public health issues.

Research and Monitoring

1. Survey *E. coli* (develop strep./*E. coli* ratios) on a repetitive basis, plus after heavy rains or storm events. This will be a general indicator of effluent impacts. For any areas showing high counts, develop more intensive monitoring and include nutrients and heavy metals. The following areas should be surveyed:
 - a. Buxton Woods
 - b. South Nags Head/Bodie Island
 - c. Other villages: Avon, Ocracoke, etc.; the emphasis near villages should be along the sound edge.

Basic monitoring should be conducted by the park. The park should check current state monitoring for potential cooperation. The park will need to establish basic lab capability; all sampling should follow Environmental Protection Agency assessment monitoring procedures and be conducted by EPA-certified labs/personnel.

2. Conduct, in addition to *E. coli*, physical chemistry (DO, salinity, conductivity) of mosquito and drainage ditches in the South Nags Head/Bodie Island area. This should be done on a repetitive basis and after storm events. Monitoring should be done by the park; the park therefore needs to acquire the necessary meters and equipment. This monitoring will establish the present environmental conditions in the ditches and provide information on water quality relative to use of the ditches by native fauna.

3. Determine the extent and rate of lateral movement of drainfield effluents in the water table as well as the necessary buffer zone between septic tanks and park resources. This should be attempted first through a literature review and test wells (4-5 foot depth, measuring *E. coli* and nitrogen). It is necessary to establish minimum buffer zones for Buxton Woods wetlands for the South Nags Head/Bodie Island system. This should be pursued as a student project or through a university.
4. Conduct fisheries survey (juvenile forms) of drainage ditches connecting South Nags Head to the sound, and along the sound edge in this area. Preliminary survey should be carried out in August and continue for one year. This should be pursued as a student project or through a university.
5. Sample marsh areas adjacent to road for lead during high traffic period of the year, in order to establish baseline levels. Samples should be collected by the park or as a student project, and run by a certified lab.
6. Determine the nutrient uptake and filtering potential of vegetation along the North Carolina Power right-of-way along South Nags Head (as a mitigation of urban effluents).

Priority Three

The development of a successful water management program and the mitigation of development impacts will require the support of an informed public. The advisory team felt the need for an immediate synthesis of known information regarding the significance of the park's fresh aquatic systems, the anticipated stresses upon those systems from future development, and the tolerances of those plants and animals dependent on them. The synthesis should be on two levels: One, a technical level for use by scientists and managers; and two, non-technical, to be used for public education and interpretive programs to generate public awareness of water management programs.

This information will provide management with specific information on the resources threatened by development. It will also provide valuable interpretive information for the park and other agencies. It was suggested that the park pursue cooperative development and dissemination of this information through Sea Grant, or as a

- a. The frequency and extent of overwash.
- b. Elevational changes in dune lines and other topographic features.
- c. Vegetation changes initiated by overwash and sea level rise.
- d. Changes in the fresh water lens via a series of wells aligned to detect salt water intrusion.

Several scientists have already completed either geologic or vegetation transects that will potentially provide useful data on shoreline and vegetation changes. Robert Dolan has established shoreline monitoring, and Bill Odum and Susan Bratton have established vegetation transects. These projects should be continued and/or expanded. Further work is best accomplished by professional scientists via NPS contract or other funding sources.

Second sub-priority. Expansion of photo point monitoring and use of aerial photos to document major ecological changes.

The park needs a complete set of photo points to document existing vegetation along park roads and the present location and structure of park wetlands. This project may be accomplished either by park staff or by students seeking individual projects.

Third sub-priority. A predictive model of sea level rise.

Anticipated accelerated rates of sea level rise will cause increased flooding within the park. Existing wetlands may disappear. Predictions of long-term change will help deal with issues concerning developments, such as the maintenance and drainage of the present road system. Models may also indicate that some forms of natural resource protection are unnecessary because the natural features themselves are too ephemeral to warrant repeated expenditure of the park's limited fiscal or personnel resources. This project is best accomplished by a contract with a university-based research group or by an interagency effort.

Fourth sub-priority. A hydrodynamic model of Pamlico Sound.

Our understanding of estuarine pollution problems could be greatly enhanced by a better knowledge of currents and flushing rates in Pamlico Sound. A hydrodynamic model would provide estimates of the residence time of pollutants. This project is best accomplished by a professional hydrologic research group or by an interagency effort.

